CLAIMS

The embodiments of an invention in which an exclusive property or right is claimed are defined as follows:

1. A physical neural network, comprising:

a connection network comprising a plurality of molecular conducting connections suspended within a connection gap formed between at least one input electrode and at least one output electrode, wherein at least one molecular connection of said plurality of molecular conducting connections can be strengthened or weakened according to an application of an electric field across said connection gap; and

a plurality of physical synapses formed from said molecular conducting connections of said connection network.

2. The physical neural network of claim 1 further comprising a gate located adjacent said connection gap, insulated from electrical contact by an insulation layer such as, for example, silicon dioxide.

3. The physical neural network of claim 2 wherein said gate is connected to logic circuitry which can activate or deactivate individual physical synapses among said plurality of physical synapses.

4. The physical neural network of claim 2 wherein said gate is connected to logic circuitry which can activate or deactivate groups of physical synapses of said plurality of physical synapses.

5. The physical neural network of claim 1 wherein said molecular conducting connections comprise semi-conducting molecular structures.

6. The physical neural network of claim 5 wherein said semi-conducting molecular structures comprise semi-conducting nanotubes.

7. The physical neural network of claim 5 wherein said semi-conducting molecular structures comprises semi-conducting nanowires.

8. The physical neural network of claim 5 wherein said semi-conducting molecular structures comprise semi-conducting nanoparticles.

9. The physical neural network of claim 1 wherein said at least one input electrode comprises a pre-synaptic electrode and said at least one output electrode comprises a post-synaptic electrode.

10. The physical neural network of claim 9 wherein a resistance of said molecular conducting connections bridging said at least one pre-synaptic electrode and said at least one post-synaptic electrode is a function of a prior electric field across said at least one pre-synaptic electrode and said at least post-synaptic electrode.

11. The physical neural network of claim 9 wherein at least one generated pulse from said at least one pre-synaptic electrode and at least one generated pulse from said at least one post-synaptic electrode is determinative of synaptic update values thereof.

12. The physical neural network of claim 9 wherein a shape of at least one generated pulse from said at least one pre-synaptic electrode and at least one generated pulse from said at least one post-synaptic electrode is determinative of synaptic update values thereof.

13. The physical neural network of claim 11 wherein said physical neural network comprises an adaptive neural network which is trainable based on said at least one generated pulse across said at least one pre-synaptic electrode and at least one generated pulse across said at least one post-synaptic electrode.

14. The physical neural network of claim 1 wherein said molecular electrically conducting connections comprise molecular electrically conducting structures suspended within a non-electrically conducting solution.

15. The physical neural network of claim 1 wherein said molecular conducting connections comprise molecular semi-conducting structures suspended within a non-conducting solution.

16. The physical neural network of claim 1 wherein a variable increase in a frequency of said electrical field across said connection gap strengthens said molecular conducting connections thereof.

17. A physical neural network, comprising:

a connection network comprising a plurality of molecular conducting connections suspended within a connection gap formed between at least one input electrode and at least one output electrode, wherein at least one molecular connection of said plurality of molecular conducting connections can be strengthened or weakened to an application of an electric field across said connection gap;

a plurality of physical synapses formed from said molecular conducting connections of said connection network;

a gate located adjacent said connection gap and which is insulated from said connection network; and

wherein a variable increase in a frequency of said electrical field across said connection gap strengthens said molecular conducting connections thereof.

18. The physical neural network of claim 17 wherein said molecular conducting connections comprise molecular conducting structures suspended within a non-conducting solution.

19. The physical neural network of claim 17 wherein said molecular conducting connections comprise molecular semi-conducting structures suspended within a nonconducting solution.

20. An adaptive physical neural network, comprising:

a connection network comprising a plurality of molecular conducting connections suspended within a connection gap formed between at least one pre-synaptic electrode and at least one post-synaptic electrode, wherein at least one molecular connection of said plurality of molecular conducting connections can be strengthened or weakened to an application of an electric field across said connection gap and said at least one pre-synaptic electrode and said at least one post-synaptic electrode;

a plurality of physical synapses formed from said molecular conducting connections of said connection network;

a gate located adjacent said connection gap and which is insulated from said connection network;

wherein a variable increase in a frequency of said electrical field across said connection gap strengthens said molecular conducting connections thereof.

wherein said adaptive physical neural network which is trainable based on at least one generated pulse across said at least one pre-synaptic electrode and at least one pulse generated across said at least one post-synaptic electrode; and

wherein a resistance of said molecular conducting connections bridging said at least one pre-synaptic electrode and said at least one post-synaptic electrode is a function of a prior electric field across said at least one pre-synaptic electrode and said at least post-synaptic electrode.